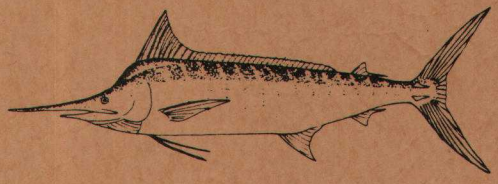
NOAA Technical Memorandum NMFS-SEFC-106

Oceanic Gamefish Investigations: Statistical Results of Billfish Data Collected 1972 - 1981



ALLYN MONTY LOPEZ

September 1982

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southeast Fisheries Center
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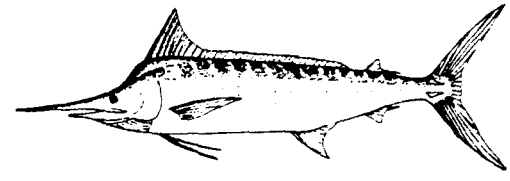

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This TM series is used for documentation and timely communication of preliminary results, interim reports, or special purpose information, and have not received complete formal review, editorial control, or detailed editing.

U.S. DEPARTMENT OF COMMERCE
Malcolm Baldrige, Secretary

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
John V. Byrne, Administrator

NATIONAL MARINE FISHERIES SERVICE
William G. Gordon, Assistant Administrator for Fisheries

INTRODUCTION

Oceanic Gamefish Investigations were started in 1972 by the Southeast Fisheries Center (SEFC) to collect and evaluate recreational catch and effort data to aid in determining the status of the stocks of blue marlin (Makaira nigricans), white marlin (Tetrapturus albidus), and sailfish (Istiophorus platypterus), and to study their biology, life history, and ecology. This report presents and summarizes data collected for the years 1972 through 1981. Data were initially collected by Oceanic Gamefish Investigations (Miami Laboratory) personnel. In 1978, responsibility for the collection of data was transferred to the Office of Technical and Information Management Services (TIMS) of the SEFC. Data came from various fishing areas located throughout the Gulf of Mexico, the Caribbean, the Bahamas, the east coast of the United States, and the Florida Keys. This publication is made possible through the cooperation given by sport fishermen, charter boat captains, and other big game fishing enthusiasts.

Care must be taken when examining the results of the various tables and figures throughout this paper. Some tables and figures include averages for total areas or totals by species. When grouping results in this manner, areas where data were plentiful tend to influence the norm or averages more so than areas having few data. Throughout the paper, every attempt was made to present the data so that each geographical area can be examined separately. When information does not occur on a figure it means either not enough data were available for analysis or no data were available from that area for a particular species.

Fishermen have contributed much in the way of biological samples and tag and release information. Data from these contributions are

presented in the appendix which briefly explains some associated billfish research and its progress.

SURVEY METHODOLOGY

Data collection is conducted by biologists and port samplers throughout the east coast of the United States, the Gulf of Mexico, the Bahamas and the Caribbean. Data was collected only from people who were trolling for billfish. In the Gulf of Mexico, port samplers have been stationed at the following ports: Port Aransas, Texas; Grand Isle, and South Pass, Louisiana; Mobile, Alabama/Pensacola, Florida; and Destin, Florida. Additional port samplers were hired in 1981 in an effort to document all blue marlin and white marlin caught in the Gulf of Mexico. One biologist, located in Panama City, Florida, is responsible for the Gulf of Mexico data.

Prior to 1980, biologists from Miami collected only tournament data from the Atlantic. In 1980, a contract was issued to collect dock (non-tournament) and tournament data from most states on the east coast of the United States. State biologists from South Carolina and Florida provide data from their respective states.

Biologists from the Miami facility cover the Caribbean and the Bahamas. Information from the east coast and the Gulf of Mexico is collected from May-October and contains both dock and tournament data. The Bahamas and the Caribbean information is collected from tournaments only, held from March-August. South Florida and Florida Keys data are based only on sailfish tournaments held from November-January.

Both dock and tournament data include: catch; effort (hours spent trolling); weather conditions; fishing activities related to the time of

day; species hooked, boated, tagged, released, or lost; length; weight; sex; and technique of fishing. All tables and figures presented in this paper, except for Table 1, contain only trolling effort. Table 1 presents some drifting effort for swordfish.

CATCH AND EFFORT

In the past ten years, 63,215 interviews have documented 421,769 hours of billfishing effort. Table 1 shows tournaments and dock sampling data collected in 1981. These data are representative of the kind of billfish data which have been collected since the start of the project. The collection of billfish catch and effort data began in the Gulf of Mexico. By maintaining five port samplers in the Gulf throughout the billfish season we have been able to collect much more data than in the other areas. Figure 1 gives the total hours spent trolling by area and indicates the number of hours it took to hook and/or catch a billfish. Due to the uneven distribution of the different species throughout the various locations, some numbers may be misleading. We believe our data accurately reflect billfish activity in the various areas. For example, the data show it takes less time to catch a white marlin on the east coast of the United States than in any other area. The least amount of effort expended to catch a blue marlin is in St. Thomas, Virgin Islands. The catch-per-unit of effort for sailfish was highest in south Florida and in the Keys. Of interest is the consistency in the number of hours required to hook and catch blue marlin throughout the Gulf of Mexico, the east coast of the U.S. and the Bahamas. Since more data are available from one area than the others, care must be taken when trying to compare the various geographical areas

Table 1: Tournament Name, Location, Date, Hours Fished, and Number of Fish Hooked by Species, 1981*

Tournament	Location	Date	Hours Fished	Number Hooked					
				Blue Marlin	White Marlin	Sail Fish	Sword Fish	Bluefin Tuna	Yellowfin Tuna
Pensacola International Billfish	Pensacola, FL	Jul 4-5	858:20	39	100	12	0	0	42
Pensacola International Billfish	Orange Beach, AL	Jul 4-5	330:35	7	11	0	0	0	40
	(Drifting)		21:58	0	0	0	1	0	0
Chub Cay Blue Marlin	Chub Cay, Bahamas	Jul 6-10	1239:00	36	0	5	0	0	0
Deep Sea Roundup	Port Aransas, TX	Jul 8-9	474:50	13	1	22	0	0	0
New Orleans Big Game Fishing Club Ladies Day	South Pass, LA	Jul 10-11	462:04	13	20	2	0	0	6
Ernest Hemingway Billfish	Bimini, Bahamas	Jul 13-17	605:00	10	0	6	0	0	0
	(Drifting)		7:00	0	0	0	0	0	0
Mid-Atlantic White Marlin Handicap	Ocean City, MD	Jul 17-19	372:00	1	36	0	0	0	0
Dauphin Island Deep Sea Rodeo	Dauphin Island, AL	Jul 17-19	563:05	23	16	1	0	0	133
	(Drifting)		45:58	0	0	0	1	0	0
Port Aransas Outboard	Port Aransas, TX	Jul 18-19	213:53	0	0	8	0	0	0
	(Drifting)		4:30	0	0	1	0	0	0
Grand Isle Tarpon Rodeo	Grand Isle, LA	Jul 23-25	518:35	12	19	7	0	0	10
Grand Isle Tarpon Rodeo	South Pass, LA	Jul 23-25	706:23	18	37	3	0	0	6
Poco Bueno	Port O'Connor, TX	Jul 24-25	746:05	29	27	42	0	0	14
Panama City Big Game Fishing Club Second	Panama City, FL	Jul 25-Jul 25	174:10	4	10	0	0	0	19
Challenge Cup	Ocean City, MD	Jul 25-26	66:30	0	37	0	0	0	0
Rudee Inlet Marlin Release	Virginia Beach, VA	Jul 25-26	144:30	1	35	0	0	0	0
Texas International Fishing	Port Isabel, TX	Jul 30-Aug 1	1326:52	10	13	32	0	0	14
Maryland Small Boat Tour	Ocean City, MD	Jul 31-Aug 1	46:00	1	18	0	0	0	0
Baton Rouge Big Game Fishing Club Second	South Pass, LA	Jul 31-Aug 2	283:55	7	11	0	0	0	9
New Jersey Bio Data		Jul 31-Aug 5	1690:15	1	83	0	0	0	0
Annual Fort Walton-Destin Billfish	Destin, FL	Aug 1-2	781:13	12	10	2	0	0	0
	(Drifting)		9:30	0	0	0	0	0	0
Mobile Big Game Fishing Club Ladies	Orange Beach, AL	Aug 1-2	519:45	11	11	4	0	0	63
	(Drifting)		20:00	0	0	0	1	0	0
Eagle Claw Texas Open	Freeport, TX	Aug 6-8	682:40	12	20	25	0	0	1
	(Drifting)		41:00	0	0	0	0	0	0
Gulf Coast Masters	Pensacola, FL	Aug 7-8	409:50	4	21	1	0	0	45
Gulf Coast Masters	Dauphin Island, AL	Aug 7-8	240:20	7	6	0	0	0	43
Dean Hawn Memorial Billfish	Port Aransas, TX	Aug 7-8	544:50	8	3	38	0	0	1
Chiquita	Port Isabel, TX	Aug 8-Aug 8	239:59	1	2	5	0	0	0
Empire-South Pass Fishing Rodeo	South Pass, LA	Aug 13-15	772:57	14	37	6	0	0	13
St. Thomas Invitational Blue Marlin	St. Thomas, VI	Aug 13-17	265.22	60	0	0	0	0	0
Atlantic City White Marlin-Swordfish	Atlantic City, NJ	Aug 14-15	280.00	0	12	0	0	0	0

Table 1 (Continued)

Tournament	Location	Date	Hours Fished	Number Hooked: Blue Marlin	White Marlin	Sail Fish	Sword Fish	Bluefin Tuna	Yellowfin Tuna
Panama City Captains Day Billfish	Panama City, FL	Aug 14-15	983:10	29	17	4	0	0	191
	(Drifting)		42:56	0	0	0	2	0	0
Pensacola Ladies	Pensacola, FL	Aug 15-16	370:20	4	4	0	0	0	53
	(Drifting)		3:00	0	0	0	0	0	0
Key Allegro Fishing	Key Allegro, TX	Aug 15-16	141:15	7	2	4	0	0	0
	(Drifting)		22:00	0	0	0	0	0	0
Ocean City Bio Data		Aug 18-19	702:00	1	142	1	0	0	0
Port Aransas Rod and Reel	Port Aransas, TX	Aug 22-23	54:30	1	0	3	0	0	0
Panama City Big Game Fishing Club Third	Panama City, FL	Aug 29-Aug 29	121:52	9	10	0	0	0	15
Alabama International	Pensacola, FL	Sep 4-5	38:00	1	2	1	0	0	0
Alabama International	Orange Beach, AL	Sep 4-5	1392:40	32	40	5	0	0	94
	(Drifting)		136:44	0	0	0	6	0	1
San Juan International Billfish	San Juan, PR	Sep 4-6	1647:00	94	3	3	0	0	0
Virginia Beach Blue Marlin	Virginia Beach, VA	Sep 4-7	382:01	0	183	0	0	0	0
	(Drifting)		12:05	0	83	0	0	0	0
New Orleans Big Game Fishing Club Labor Day	South Pass, LA	Sep 5-7	366:42	11	2	0	0	0	41
Ocean City Annual White Marlin Open	Ocean City, MD	Sep 6-7	498:10	1	61	0	0	0	0
Budweiser Bartender Open	Ocean City, MD	Sep 8-9	216:00	1	17	0	0	0	0
Oregon Inlet Fishing	Oregon Inlet, NC	Sep 16-18	678:15	10	12	14	0	0	0
Annual Destin Billfish	Destin, FL	Sep 18-20	945:30	44	30	7	0	0	21
New Orleans Big Game Fishing Club September	South Pass, LA	Sep 18-20	113:32	2	1	0	0	0	6
Hatteras Invitational	South Pass, LA	Sep 25-26	368:55	17	34	0	0	0	11
Orange Beach Invitational	Orange Beach, AL	Oct 9-10	361:30	12	22	0	0	0	2
Bluewater Classic	Orange Beach, AL	Oct 9-11	346:05	13	33	4	0	0	4
Islamorada Sailfish (live bait)	Islamorada, FL	Dec 2-6	1197:13	0	0	168	0	0	0
Dock Sampling:									
Padre Island Docks	Trolling	Jan 3-Oct 29	1387:42	61	23	44	1	9	24
Port Aransas Docks	Trolling	Feb 21-Oct 28	2308:04	78	16	134	0	0	16
	Drifting		21:59	0	0	1	0	0	0
Destin Docks	Trolling	Apr 6-Nov 22	2629:28	73	100	21	0	0	2
	Drifting		83:17	0	1	0	4	0	0
South Pass Docks	Trolling	Apr 17-Oct 18	1187:15	58	38	3	0	0	29
	Drifting		10:20	0	0	0	0	0	0

Table 1 (Continued)

Tournament	Location	Date	Hours Fished	Number Hooked					
				Blue Marlin	White Marlin	Sail Fish	Sword Fish	Bluefin Tuna	Yellowfin Tuna
Masters Invitational Sailfish	Palm Beach, FL	Jan 13-17	765:30	0	2	250	0	0	0
Invitational Gold Cup	Palm Beach, FL	Jan 21-24	1249:00	2	1	391	0	0	0
Frankie Brown Memorial	Bimini, Bahamas	Mar 10-14	1055:40	14	25	0	0	0	4
Annual Bacardi Billfish	Bimini, Bahamas	Mar 17-21	645:30	16	21	0	0	0	0
Annual His and Hers Billfish	Chub Cay, Bahamas	Mar 30-Apr 3	473:00	8	11	0	0	0	0
Bertram-Hatteras Billfish	Bimini, Bahamas	Apr 9-11	883:50	30	29	1	0	2	1
Members Only Billfish	Chub Cay, Bahamas	Apr 27-May 1	287:00	11	8	0	0	0	0
Walkers Cay Annual Billfish	Walkers Cay, Bahamas	May 4-8	2822:00	49	28	2	0	0	0
New Orleans Big Game Fishing Club First	South Pass, LA	May 8-10	215:49	7	2	0	0	0	3
Atlantic Blue Marlin Open	Sea Pines, SC	May 15-17	300:55	43	5	0	0	0	0
Georgetown Blue Marlin	Georgetown, SC	May 22-24	455:20	37	4	0	0	0	0
Mobile Big Game Fishing Club Memorial Day	Orange Beach, AL	May 23-24	154:15	9	4	0	0	0	1
South Pass Memorial Day	South Pass, LA	May 23-25	520:38	8	3	1	0	0	5
Old Salt	St. Petersburg, FL	May 29-31	583:30	3	2	11	0	0	0
Big Rock Blue Marlin	Moorehead City, NC	Jun 1-5	579:20	7	5	0	0	0	1
Bimini Big Game Fishing Club Members Only	Bimini, Bahamas	Jun 2-6	297:30	4	4	10	0	1	0
Golden Meadow Big Game Fish. Club Invitational	Grand Isle, LA	Jun 4-7	591:15	25	32	2	0	0	44
Baton Rouge Big Game Fishing Club	South Pass, LA	Jun 5-7	70:40	2	4	0	0	0	1
Hatteras Blue Marlin	Hatteras, NC	Jun 8-13	1027:15	38	66	2	0	0	0
New Orleans Big Game Fish. Club Tag and Release	South Pass, LA	Jun 12-14	189:00	6	4	0	0	0	6
Panama City Big Game Fishing Club First	Panama City, FL	Jun 13-Jun 13	120:30	1	2	0	0	0	1
Cat Cay Blue Marlin	Cat Cay, Bahamas	Jun 15-19	979:30	21	4	11	0	0	0
Destin Summer Open Billfish	Destin, FL	Jun 19-20	790:00	12	55	5	0	0	19
	(Drifting)		9:00	0	0	0	0	0	0
Baton Rouge Big Game Fish. Club Invitational	South Pass, LA	Jun 19-21	355:10	28	22	0	0	0	3
Port Aransas Masters Billfish	Port Aransas, TX	Jun 20-21	339:53	10	0	6	0	0	2
	(Drifting)		8:59	0	0	0	0	0	0
Bimini Blue Marlin	Bimini, Bahamas	Jun 23-27	1392:45	66	5	15	0	0	0
New Orleans Big Game Fish. Club Invitational	South Pass, LA	Jun 25-27	2334:15	79	94	3	0	0	69
Broadbill Ocean City	Ocean City, MD	Jun 27-28	24:00	0	12	0	0	0	0
	(Drifting)		71:30	0	0	0	1	0	0
Texas Championship Billfish	Port Aransas, TX	Jun 27-28	963:01	24	16	61	0	0	0
Captain Fanny Blue Marlin	Beaufort, NC	Jun 29-Jul 3	1179:55	21	14	1	0	0	38
Florida Sportfishing Center	St. Petersburg, FL	Jul 3-4	126:00	3	3	10	0	0	0
Golden Meadow Tarpon Rodeo	Grand Isle, LA	Jul 3-5	75:30	3	4	0	0	0	14
General Ray Huff Billfish	South Pass, LA	July 3-5	364:01	16	17	4	0	0	18

Location	Location	Date	Hours Fished	Number Hooked: Blue Marlin	White Marlin	Sail Fish	Sword Fish	Bluefin Tuna	Yellowfin Tuna
Mobile Docks	Trolling	May 3-Oct 18	1302:23	43	53	10	0	0	224
	Drifting		45:41	0	0	0	3	0	0
Oregon Inlet Docks	Trolling	May 10-Sep 14	4908:39	112	881	138	0	0	0
Grand Isle Docks	Trolling	May 16-Sep 7	971:19	39	50	2	0	3	18
	Drifting		96:14	0	0	0	0	0	0
Mississippi Docks	Trolling	May 21-Sep 25	284:28	11	6	0	0	0	5
Pensacola Docks	Trolling	May 22-Nov 4	282:45	5	28	5	0	0	2
Panama City Docks	Trolling	May 23-Oct 11	627:25	13	43	4	0	1	56
	Drifting		54:21	0	0	0	1	0	0
Galveston Docks	Trolling	Jun 1-Oct 11	689:30	42	28	59	0	0	0
	Drifting		120:00	2	0	15	1	0	0
Hatteras Docks	Trolling	Jun 12-Jun 12	48:30	3	1	1	0	0	0
St. Thomas Docks	Trolling	Jun 14-Aug 12	270:00	108	0	0	0	0	0
New Jersey Docks	Trolling	Jun 14-Sep 26	109:30	0	6	0	1	0	0
Virginia Docks	Trolling	Jun 20-Aug 2	663:59	13	146	1	0	0	0
Ocean City Docks	Trolling	Jun 24-Sep 6	767:00	6	224	0	0	0	0
	Drifting		32:00	0	0	0	1	0	0
New England Docks	Trolling	Jun 27-Sep 8	479:59	3	59	0	3	0	0
	Drifting		145:10	0	6	0	13	0	0

*Tournaments sampled by NMFS personnel or by personnel from cooperating agencies, 1981.

Figure 1. 1972-1981 Summary of Hours Spent Trolling for Big Game Fishes by Geographical Area.

	GULF OF MEXICO	EAST COAST	BAHAMAS	CARIBBEAN	ALL 4 AREAS	S. FLORIDA & KEYS
TOTAL HOURS TROLLED	214,221	60,587	67,020	25,169	366,997	54,772
NO. OF FISH BOATED* BY SPECIES						
BLUE MARLIN	2,303	675	789	617	4,384	15
WHITE MARLIN	5,453	4,446	621	131	10,651	35
SAILFISH	2,969	305	323	230	3,827	5,649
ALL SPECIES	10,725	5,426	1,733	978	18,862	5,699
HOURS TROLLED TO HOOK A FISH						
BLUE MARLIN	40.4	39.2	38.5	16.3	36.2	1956.1
WHITE MARLIN	23.9	8.5	56.4	76.5	21.0	817.5
SAILFISH	49.1	119.0	145.4	142.2	64.9	5.4
ALL SPECIES	11.5	6.6	19.8	12.3	11.0	5.3
HOURS TROLLED TO CATCH A FISH						
BLUE MARLIN	93.0	89.8	84.9	40.8	83.7	3651.5
WHITE MARLIN	39.3	13.6	107.9	192.1	34.5	1564.9
SAILFISH	72.2	198.6	207.5	109.4	95.9	9.7
ALL SPECIES	20.0	11.2	38.7	25.7	19.5	9.6

*Boated includes tagged and released. (Note: some numbers may be misleading due to uneven distribution of species.)

with total number. Another consideration is that in some areas data are only collected during peak periods of abundance. An example of this is for blue marlin in the Caribbean and sailfish in south Florida and the Keys. Data presented are meant to provide basic information about billfishing in five geographical locations.

Angler success is presented in Table 2 and Figure 2. Table 2 shows the number of fish hooked, boated, lost and percent boated by year, by species. This table shows from year to year, regardless of how many fish are hooked, that angler success (number of fish boated divided by the number of fish hooked) remains about the same. For blue marlin, white marlin, and sailfish, angler success is 43%, 59%, and 60%, respectively. Figure 2 shows angler success by geographical area. The angler success for each of the five areas was calculated by dividing the number of fish caught by the number of fish hooked. Angler success was plotted to show how successful anglers were in each area compared to the average, which is indicated by the heavy base line. In Figure 3 the hours trolled to hook a billfish are plotted. The straight line across each section is the ten-year average for all areas combined. The ten year averages for blue marlin, white marlin, and sailfish respectively are 41.5 hours, 24.1 hours, and 26.6 hours. This figure indicates that local availability of billfish fluctuates from year to year. Only speculative statements can be made about this figure. Hopefully through continued monitoring of the fishery will be able to provide a better indication of yearly abundance.

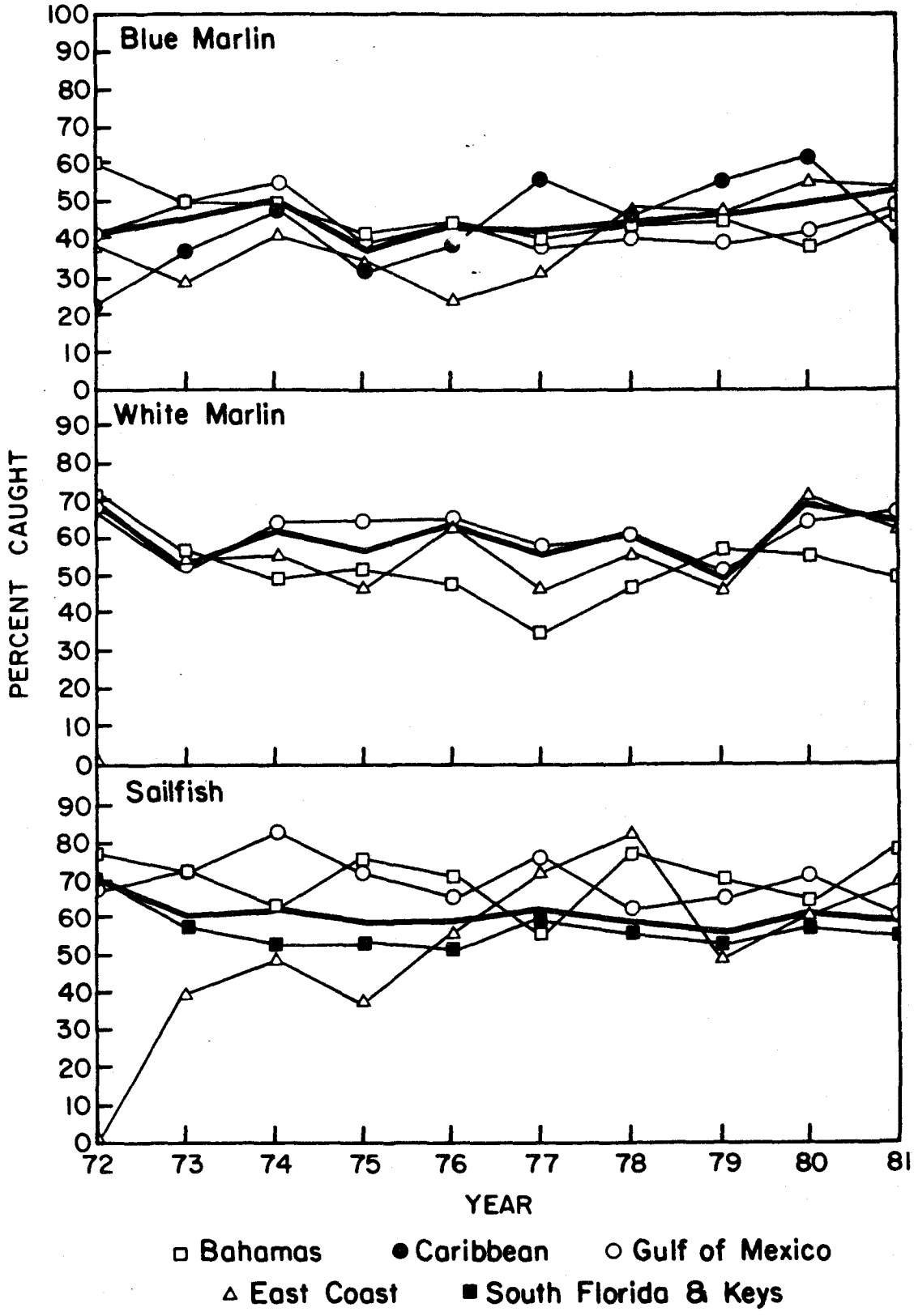
SIZE COMPOSITION

Weights of billfish have been collected to show fluctuations in sizes of billfish from year to year. Average weights of blue marlin,

Table 2. Billfish, by Species Hooked, Boated (Includes Tagged and Released), Lost and Percent Boated, 1972-1981.

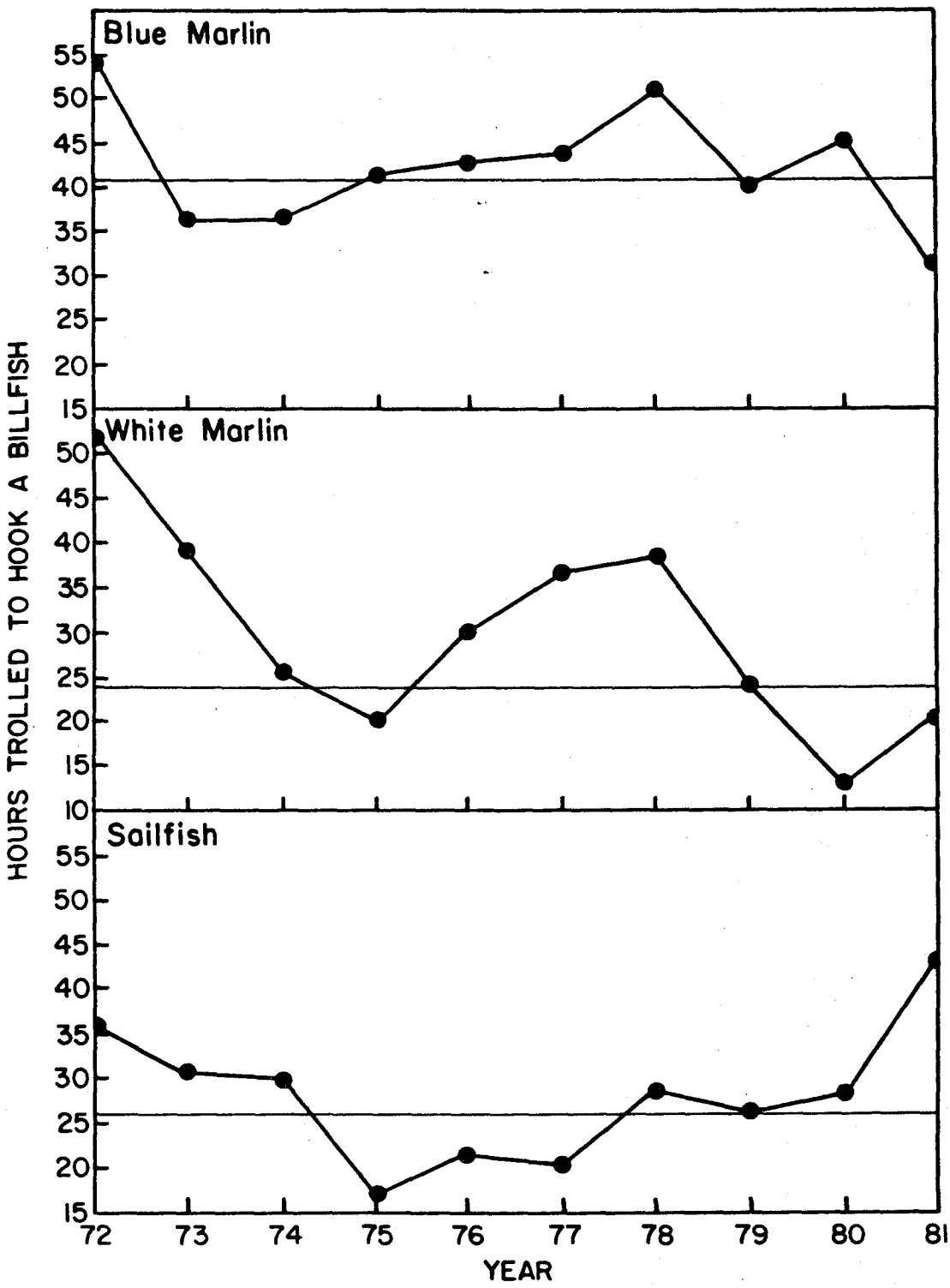
YEAR	BLUE MARLIN				WHITE MARLIN				SAILFISH			
	HOOKED	BOATED	LOST	% BOATED	HOOKED	BOATED	LOST	% BOATED	HOOKED	BOATED	LOST	% BOATED
1972	660	267	393	40.5%	683	461	222	67.5%	1003	695	308	69.3%
1973	689	287	402	41.7%	646	343	303	53.1%	812	495	317	61.0%
1974	842	407	435	48.3%	1179	693	486	58.8%	1030	637	393	61.8%
1975	878	335	543	38.2%	1766	991	775	56.1%	2098	1242	856	59.2%
1976	842	341	501	40.5%	1184	736	448	62.2%	1664	984	680	59.1%
1977	995	405	590	40.7%	1176	637	539	54.2%	2222	1386	836	62.4%
1978	1051	443	608	42.2%	1397	826	571	59.1%	1931	1110	821	57.5%
1979	1017	433	584	42.6%	1703	851	852	50.0%	1590	851	739	53.5%
1980	1286	588	698	45.7%	4620	3128	1492	67.7%	2045	1216	829	59.5%
1981	1912	899	1013	47.0%	3193	2020	1173	63.3%	1466	869	597	59.3%

Figure 2. Angler Success Plotted in Percent by Species and by Geographical Area, 1972-1981.



Note: Heavy base line indicates average angler success for all geographical areas combined.

Figure 3. Hours Trolled to Hook a Billfish, by Species, 1972-1981.



Note: Straight line represents the ten-year combined average.

white marlin, and sailfish sampled by program personnel over the ten-year period were 245 pounds (111.4 kg), 55 pounds (25 kg), and 42 pounds (19.1 kg), respectively. Annual smallest, largest, and average weights are presented in Table 3. In Figure 4 the average weights of billfish by species and by area are plotted. The heavy solid line on each figure shows the average weight wher data from all areas are combined. For blue marlin, fish from the Gulf of Mexico and the East Coast were larger than average and fish from the Caribbean were smaller than average. During the ten-year period, the average weight shows a gradual increase in size of blue marlin. White marlin from the Bahamas were consistently larger than the average, while white marlin from the Gulf of Mexico and the East Coast are about average. The ten-year average for white marlin showed a slight decrease in size. Sailfish from the south Florida/Keys area are smaller than the combined average. This is due to the catch of many fish that have probably spawned within previous months. The sailfish data from the keys are collected in November through February when the sailfish are schooling in those areas.

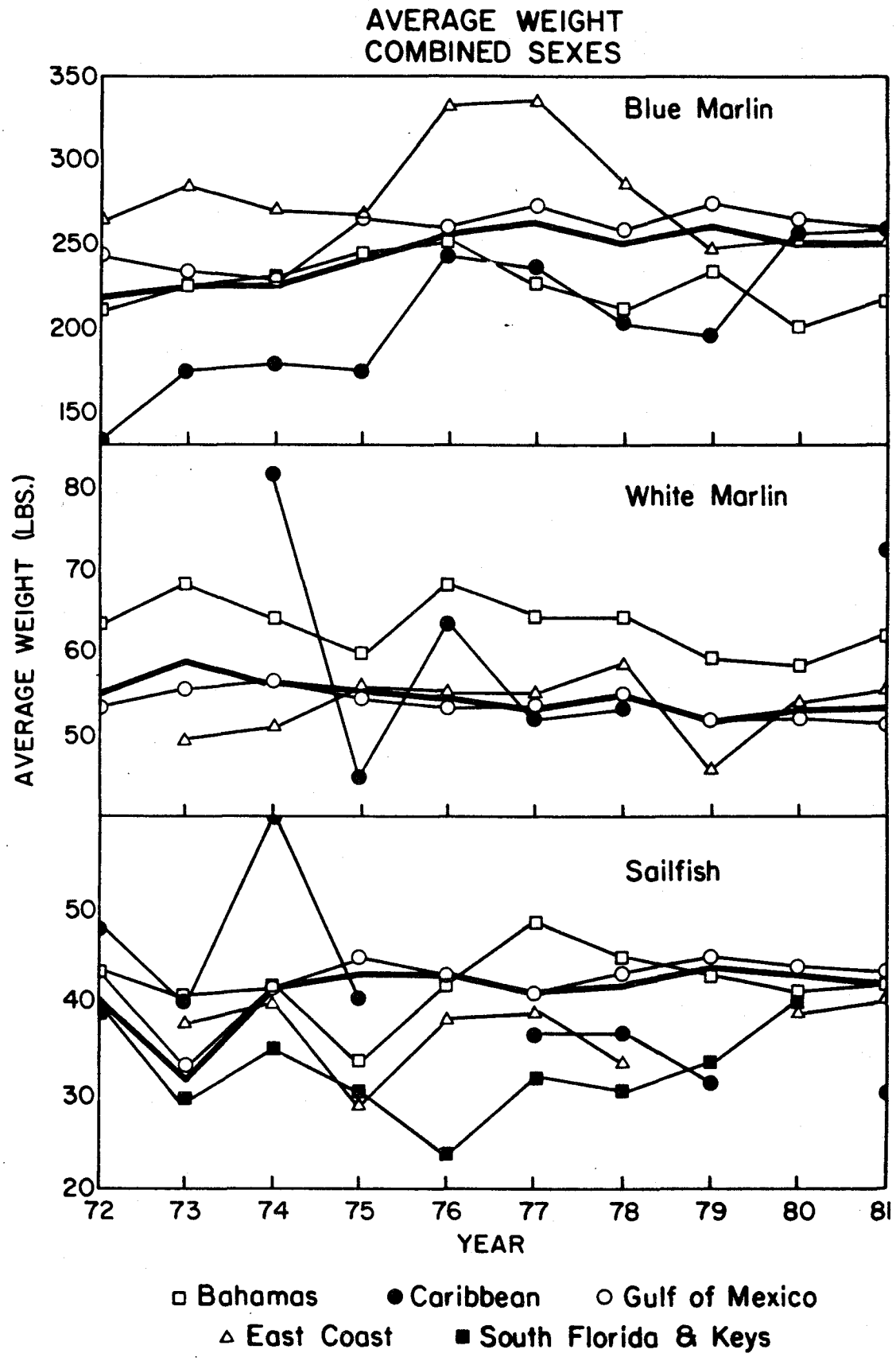
SEX COMPOSITION

Throughout the billfish program, port samplers and biologists examined billfish for sex determination. Table 4 presents these data by species for each year. Sixty percent of the fish brought to the dock have been examined for sex data. Over the ten year period the female to male ratio was 1.9:1 for blue marlin; 1.6:1 for white marlin; and 1.5:1 for sailfish.

Table 3. Smallest, Largest, and Average Weight of Billfish, 1972-1981.

YEAR	BLUE MARLIN			WHITE MARLIN			SAILFISH		
	SMALLEST	LARGEST	AVERAGE	SMALLEST	LARGEST	AVERAGE	SMALLEST	LARGEST	AVERAGE
1972	32.0	607.0	218.6	30.0	120.0	54.9	0.5	95.0	42.1
1973	51.5	569.0	226.4	32.6	110.5	58.8	0.5	70.8	33.0
1974	51.0	666.0	225.7	27.0	117.0	55.8	6.5	71.0	42.1
1975	84.0	569.0	241.5	35.0	105.0	55.2	4.0	84.3	42.7
1976	47.5	719.0	259.3	15.0	130.0	54.4	7.9	83.7	42.9
1977	52.0	1018.5	264.5	28.5	106.0	53.1	5.0	84.5	41.0
1978	48.0	699.0	250.5	25.0	128.0	55.1	2.0	84.0	41.6
1979	45.0	1060.5	262.1	9.8	114.0	52.2	2.0	86.0	44.4
1980	39.0	738.0	248.1	16.0	135.0	52.6	8.5	83.0	42.7
1981	48.0	784.0	249.6	20.0	118.0	52.9	5.2	82.0	42.3

Figure 4. Average Weight of Billfish by Species, by Geographical Area.



Note: Heavy base line represents average weight of all geographical areas combined.

HOOKED PER UNIT OF EFFORT

Providing an index for measuring abundance has been one of the key objectives of this program. The abundance index is calculated by dividing the number of fish hooked by the number of hours spent trolling. These numbers are expressed as the number of fish hooked per unit of effort (HPUE). Figure 5 shows the HPUE of billfish by species by year. Except for 1978, the overall HPUE for blue marlin for the ten-year period remained at .03, this is indicated by heavy base line. The HPUE for blue marlin in the Bahamas, the Gulf of Mexico and the east coast has fluctuated very little. HPUE data plotted from the Caribbean shows great fluctuations but these numbers were calculated from a much smaller data base than any of the other areas.

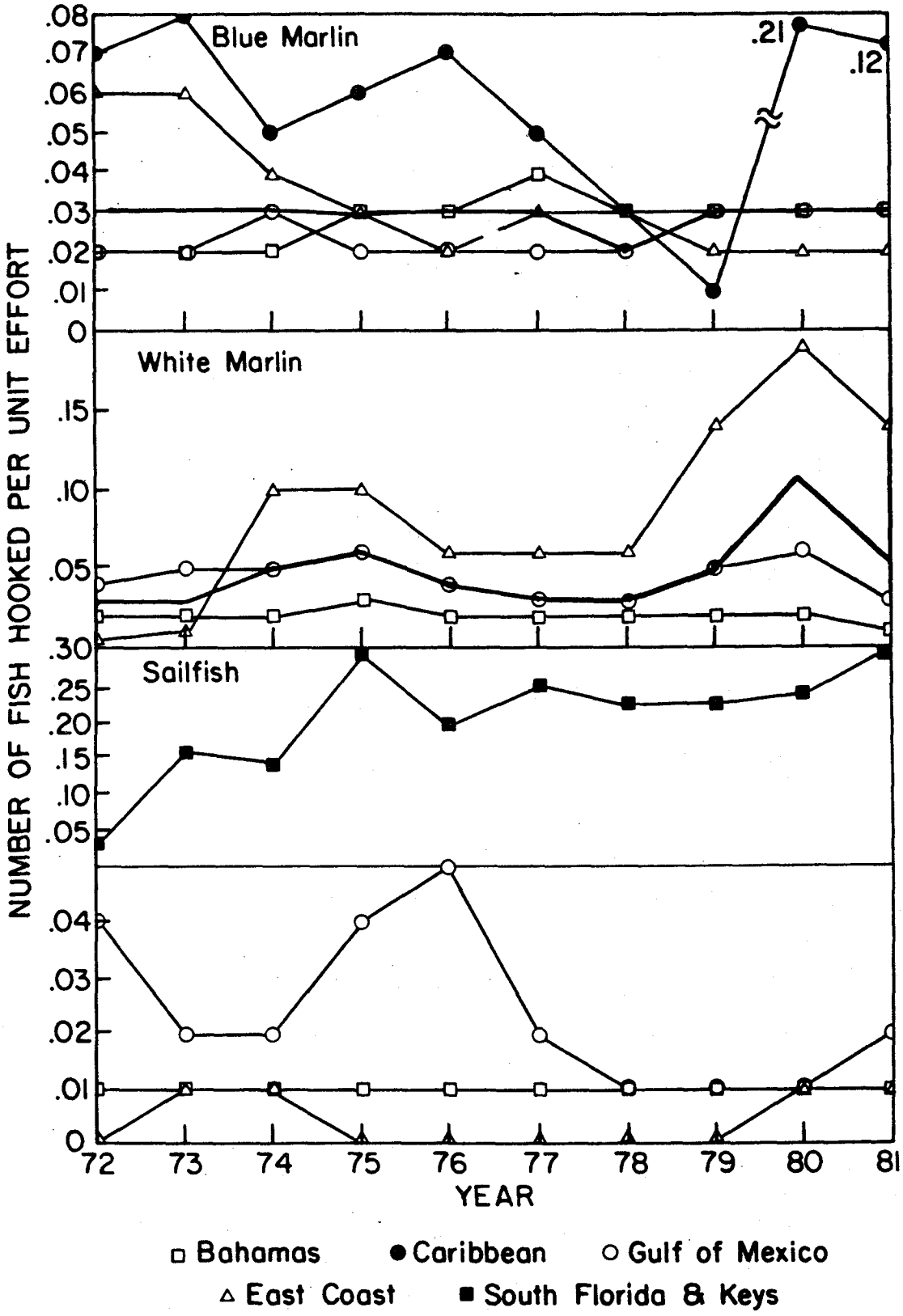
An interesting trend is noticed when the data from Chub Cay and Bimini, Bahamas are plotted separately (see Figure 6). When HPUE is high in one area it is generally low in the other area. This possibly indicates migration of billfish populations from one area to another during the season.

The overall HPUE for white marlin fluctuated very little until 1979 and 1980 when HPUE increased for two years (see Figure 5). This increase reflects the excellent white marlin fishing experienced by fishermen in the Gulf of Mexico and in Oregon Inlet, North Carolina. In 1980 more white marlin were caught in the Gulf of Mexico than the total number of billfish caught in the Gulf in 1979. In 1979 and 1980 fishermen in Oregon Inlet, North Carolina experienced some of the best white marlin fishing that local fishermen could ever remember. White marlin fishing in the Bahamas continues to be poor compared to either the Gulf of Mexico or the east Coast of the United States. In 1981 all areas experienced a decline in HPUE for white marlin.

Table 4. Sex Ratio of Billfish Examined, 1972-1981.

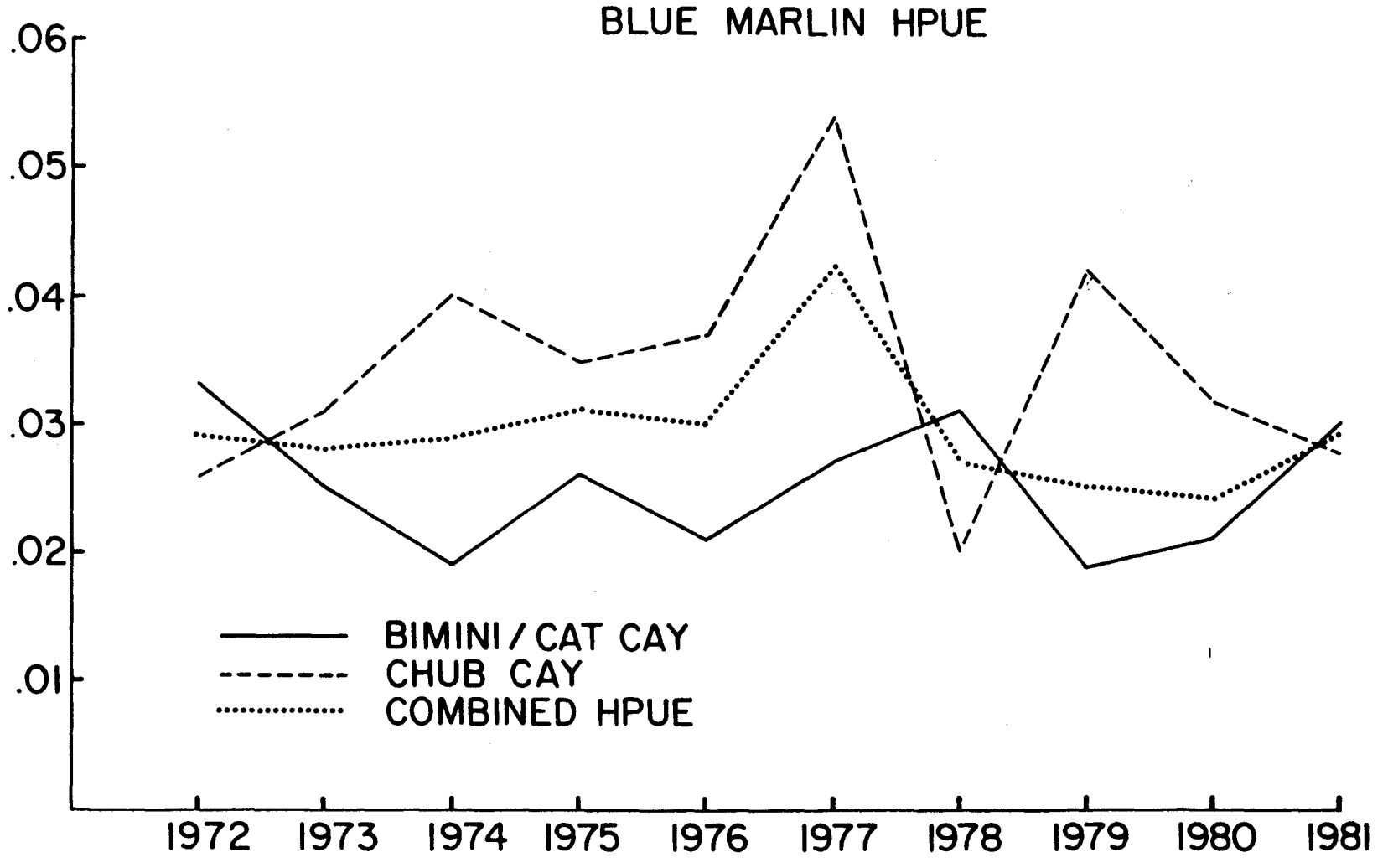
YEAR	BLUE MARLIN				WHITE MARLIN				SAILFISH			
	FEMALE	MALE	UNKNOWN	MALE/ FEMALE	FEMALE	MALE	UNKNOWN	MALE/ FEMALE	FEMALE	MALE	UNKNOWN	MALE/ FEMALE
1972	86	96	52	1:.9	124	71	119	1:1.8	115	73	228	1:1.6
1973	132	95	56	1:1.4	110	48	109	1:2.3	44	19	70	1.2.3
1974	140	125	121	1:1.1	137	103	239	1:1.3	30	27	132	1:1.1
1975	158	110	45	1:1.4	218	143	224	1:1.5	93	72	158	1:1.3
1976	166	90	55	1:1.8	194	136	147	1:1.4	99	94	156	1:1.1
1977	214	78	76	1:2.7	220	134	128	1:1.6	175	106	152	1:1.7
1978	198	92	111	1:2.2	195	178	244	1:1.1	86	54	114	1:1.6
1979	229	75	98	1:3.1	210	136	210	1:1.5	69	34	55	1:2
1980	187	80	193	1:2.3	295	174	1118	1:1.7	56	64	161	1:.9
1981	271	133	307	1:2	261	109	557	1:2.4	83	79	226	1:1.1

Figure 5. Number of Billfish Hooked Per Unit of Effort by Geographical Location, 1972-1981.



Note: Heavy base lines on blue marlin and white marlin graphs represent average HPUE of geographical areas combined.

Figure 6. Blue Marlin Hooked Per Unit of Effort (HPUE) in Various Bahamas Locations, 1972-1981.

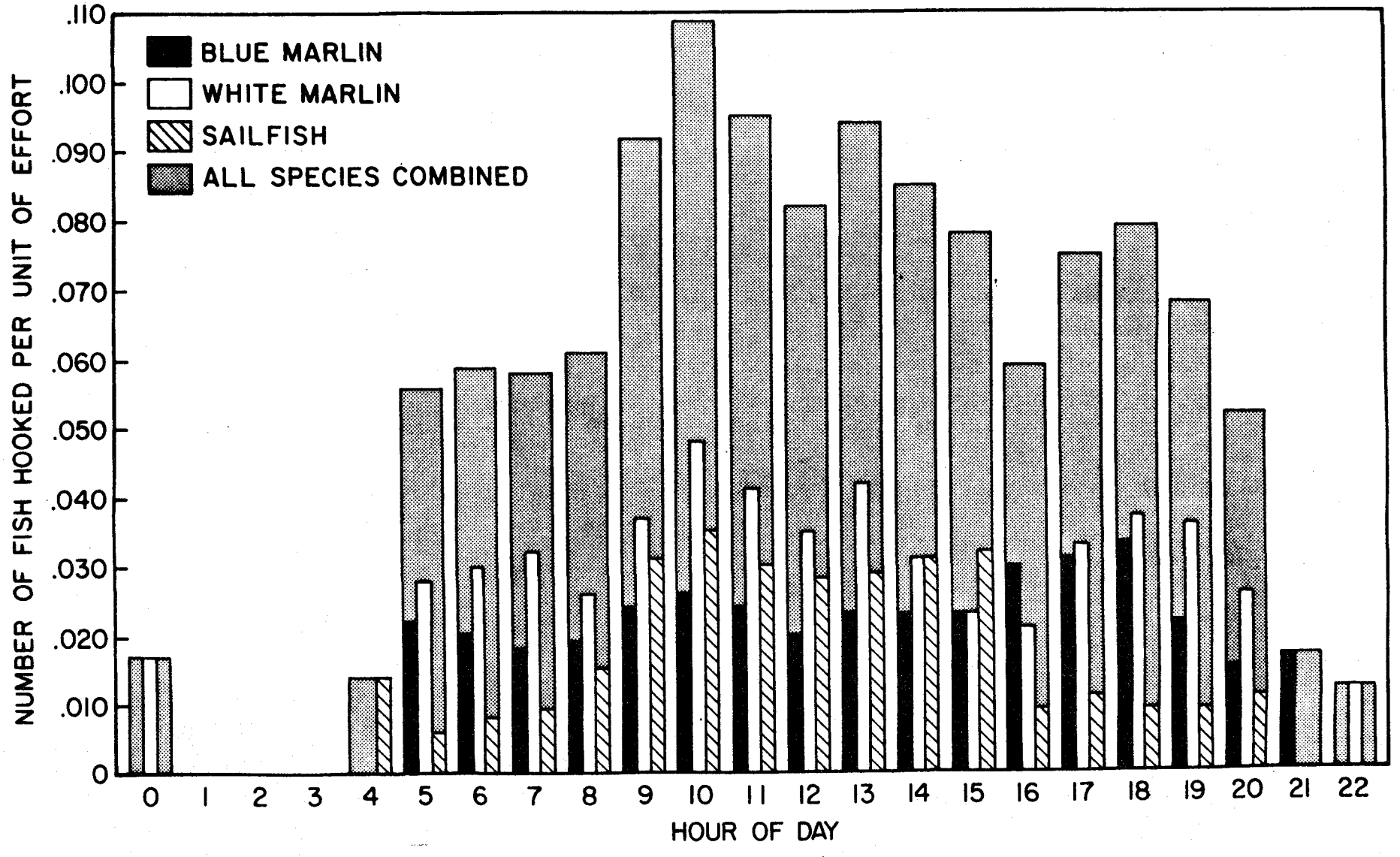


HPUE data for sailfish for the different areas varies more than for the marlins. The Florida keys have experienced an increase in HPUE since the start of our program. HPUE for the Bahamas has remained at .01. HPUE for sailfish on the east coast has fluctuated very little. HPUE for sailfish in the Gulf of Mexico reflects a continual change in the local abundance of sailfish.

NUMBER OF FISH HOOKED BY TIME OF DAY

Fishermen for all species of billfish are interested in what time of day the fish are most likely to bite. Hourly periods when billfish might bite best were calculated by taking the number of fish hooked during a particular hourly period and dividing it by the total hours fished for that period and then plotted (Figure 7). The data suggest blue marlin feed most actively around ten o'clock in the morning, a slight decline is experienced in the early afternoon and then feeding increases late in the afternoon between four and six o'clock. For blue marlin it appears a six-hour trend in feeding occurs. Feeding time for white marlin also peaks at ten o'clock in the morning, additional peaks occur at one o'clock in the afternoon and five o'clock in the afternoon. This indicates a shorter period between feeding time. While marlins feed with some consistency throughout the day; data on the sailfish indicate they feed most actively between nine o'clock in the morning and three o'clock in the afternoon. The data indicate that sailfish feed consistently throughout the day, slight peaks occur at ten o'clock in the morning and three o'clock in the afternoon.

Figure 7. Number of Billfish Hooked Per Unit of Effort by Time of Day, 1972-1981.



BAIT INFORMATION

Trolling artificial baits (lures) for billfishes has gained increasing popularity for the past four years. Fishermen in the Gulf of Mexico have experimented with artificials and have been so successful that now the majority of the Gulf effort is with artificial baits. Fishermen in other areas have shown interest in artificials but have been hesitant to switch to the extent that Gulf fishermen have. Collection of data on effectiveness of baits (i.e., artificial bait vs. natural bait vs. combination of artificial and natural baits) began in 1978, but not until 1981 did we get a good sample which we thought was accurate. HPUE for the various baits was calculated by taking the number of fish hooked while trolling a particular bait and dividing it by the number of hours spent trolling that particular bait (Table 5). In all areas, the highest HPUE occurred while trolling natural baits. Trolling only artificial bait was second and trolling both bait types simultaneously resulted in the lowest HPUE. Close analysis of the table yields some very interesting facts. In the Caribbean most of the hours trolled are with both natural and artificial baits and the data shows the lowest HPUE. Overall, the data suggests that if you are going to experiment with different types of baits, you should troll either artificials or naturals and not mix them. Apparently, the effectiveness of both natural or artificial baits decreases when trolled simultaneously. In the 1982 report, data will be presented on hook vs. catch rates for natural and artificial baits.

Table 5. Hours Trolled and Number of Billfish Hooked Per Unit of Effort, by Type of Bait, 1981.

	NATURAL BAITS (DEAD)		ARTIFICIAL BAIT (LURE)		BOTH SIMULTANEOUSLY	
AREA	HOURS TROLLED	HPUE	HOURS TROLLED	HPUE	HOURS TROLLED	HPUE
GULF OF MEXICO	3,069	.096	25,803	.083	6,565	.074
EAST COAST	8,628	.213	491	.175	3,085	.090
BAHAMAS	6,969	.050	402	.042	489	.0'0
CARIBBEAN	48	.250	12	.167	2,122	.120
KEYS	-----	----	------	----	-----	----
ALL AREAS	18,714	.133	26,708	.084	12,261	.084

APPENDIX

Biologists and port samplers in the field are questioned frequently as to how catch-effort data, tagging data, and biological samples are utilized. Questions range from "Why are you asking these questions?" to "What do you do with the samples you are collecting?" In order to provide basic information about associated billfish research and to keep interested people up to date on current findings, this appendix has been added.

LONGLINE OBSERVER PROGRAM AND FOREIGN LONGLINE ACTIVITIES

As a result of the Magnuson Fishery Conservation and Management Act of 1976, the Longline Fishery Observer Program was initiated. The law allows U.S. Observers to board foreign vessels within 200 nautical miles of the coast and record species of fish caught, document whether they are dead or alive, and to identify and describe fishing techniques. It is also required that all fish, except tunas, be released whether dead or alive. The Japanese have agreed to allow observers to tag all live billfishes before their release. Hopefully, the data collected by the Observer Program will allow us to evaluate the effects of longlining on populations of both tunas and billfishes and help with stock assessment work. Recently, many changes have taken place, and our Northeast Regional Office has taken over the observer program. Any questions pertaining to the observer program should be sent to:

Observer Program
Northeast Region
National Marine Fisheries Service
14 Elm Street
Gloucester, Massachusetts 01930

The activities of foreign longliners in our fishery conservation zone have changed considerably in the past five years. Prior to 1978 considerable effort by foreign longliners was conducted in the Atlantic and the Gulf of Mexico. Through both ICCAT decisions and U.S. negotiations with foreign countries, voluntary actions have been taken to limit both the number of fish taken and the effort expended. The Japanese did not fish in the Gulf of Mexico in 1981. Due to monitoring longline catches and realizing that stocks of bluefin tuna are overfished, only 1160 metric tons of bluefin tuna will be allowed to be taken in our Fishery Conservation Zone in 1983. Of that amount, only 26% may be landed by foreign fishery vessels. Data collected by the observer program has been used in all negotiations and has been most helpful in making reasonable decisions pertaining to foreign fishing in our FCZ.

A publication describing the longline fishery is available upon request by writing Mr. Allyn M. Lopez at the Southeast Fisheries Center.

COOPERATIVE GAMEFISH TAGGING PROGRAM

Sport fishermen play a major role in the success of the tagging program. The increasing interest in tagging by sport fishermen is appreciated. In 1981, 424 blue marlin, 766 white marlin, 1860 sailfish and 168 swordfish were tagged and released. In 1981, one blue marlin, 15 white marlin, 40 sailfish, and 8 swordfish were recaptured. The recaptured blue marlin was tagged June 27, 1981, 16 miles southeast of South Pass, Louisiana. The same fish was recaptured July 18, 1981, 95 miles east of the tagging location. A new 'time at liberty' record for white marlin was set in 1982. On July 10 a white marlin that was tagged off Ocean City, Maryland on September 26, 1970 was recaptured. The fish

was caught about 40 miles south of Block Island, New York, weighed 65 pounds and measured 71 inches fork length. It was interesting to note that the fish was reported to be in "shabby" condition (a possible indication of senility) and the tag was so completely encrusted by marine growth that it was barely recognizable as a "tag". Of utmost importance was that skeletal hard parts from the head and fins of this fish were retrieved and forwarded to the Center's Miami Laboratory for analysis of age and growth. Because the approximate age of the fish is known from tagging records, examination of its skeletal hard parts will enable scientists to validate previous estimates of age and growth of white marlin for the first time. The samples collected have provided extremely valuable information for the conservation of white marlin.

If you would like to receive a copy of the annual tagging newsletter or have any questions about the tagging program, please contact Mr. Ed Scott, Southeast Fisheries Center, 75 Virginia Beach Drive, Miami, Florida 33149-1099.

SUMMARY OF BIOPROFILES MARLIN RESEARCH

Research to determine the age and growth rate of blue and white marlin has been conducted by the bioprofiles task of the Miami Laboratory (NMFS) since 1980. Initially, investigations were directed towards determining which skeletal hardparts could be used as a source of age and growth information. Growth bands have been observed on anterior dorsal spines, otoliths (ear bones), anterior vertebrae, and anal spines (in descending order of importance) which demonstrated potential for age and growth estimation. To date, skeletal hardparts from 152 blue marlin (47 males, 95 females, 10 sex unknown) and 128

white marlin (31 males, 84 females, 13 sex unknown) have been collected. The bioprofiles staff is in the process of developing growth increment enhancement techniques for spines and vertebrae, while the University of South Carolina (Belle Baruch Institute) will be using scanning electron microscopy to analyze age and growth from otoliths (through a cooperative research agreement with NMFS).

Besides making estimates of age and growth rates based on growth bands on skeletal hardparts, bioprofiles staff are pursuing various approaches to validating these estimates. One approach is to collect a series of samples from unusually small specimens to determine the average size when marlin form their first growth bands. Collecting different hardparts from the same specimen also provides indirect documentation of the time sequence of band formation. The second major effort in validating the periodicity of band formation is to collect skeletal hardparts from tag-recaptured marlin where age can be closely approximated from tagging records. This technique is most effective when a tag-return is from a fish that had been at large for a long period. For example, the recent tag-return (1982) of the white marlin cited above resulted in an estimate of age of <u>at least</u> 13 years old. Analyses of the hardparts should provide valuable information.

The large geographical range and mobility of marlin has hindered the acquisition of samples for age and growth studies in the past. Personnel at Miami Laboratory are making a major sampling effort by taking samples from taxidermy facilities and various billfish tournaments in the Gulf of Mexico, Caribbean Sea and along the entire East Coast. In addition, the ICCAT is participating in this effort by seeking hardparts from tag-recaptured marlin throughout the eastern

Atlantic Ocean and Mediterranean Sea. U.S. observers on foreign commercial vessels are also collecting these data.

A limited number of ichthyoplankton cruises were conducted by the bioprofiles task in FY-82 to obtain samples of billfish larvae and juveniles for age and growth determination using otolith microstructure analysis. This research is being conducted in cooperation with Dr. Edward B. Brothers, Cornell University. For more information contact

Dr. Eric Prince
Southeast Fisheries Center
75 Virginia Beach Drive
Miami, Florida 33149-1099

ACKNOWLEDGMENTS

A great deal of gratitude is extended to all of the anglers, crews, and tournament managers for their cooperation and patience in providing us with their fishing data. We particularly thank the South Carolina Wildlife and Marine Resources Department for their continued support. For the Gulf of Mexico data, we are grateful for the continued support by the various big game fishing clubs and charterboat associations from Texas to Florida. We also thank the Bimini Big Game Fishing Club, the Cat Cay Club, the Chub Cay Club, the Club Nautico de San Juan, and the directors of the Governors Invitational Blue Marlin Tournament. Special recognition is extended to Alicia de Armas for her help in preparing tables and organizing the data and special thanks to Dave Senn (NOAA-AOML) for drafting all of the tables and figures for this paper.